



# **Real Options Reasoning In Healthcare: An Integrative Approach And Synopsis**

By: **David R. Williams** and Paul H. Hammes

## **Abstract**

For the past 40 years, practitioners and researchers alike have been grappling with the natural shortcomings associated with the net present value approach to strategic decision making and capital budgeting. Work by scholars in option pricing theory has evolved into an alternative perspective on strategic capital investments, called "real options." Proponents of real options argue that this is a superior way of approaching decision making and capital budgeting, compared with other approaches, as it allows for greater strategic flexibility and encourages exploration, experimentation, and innovation. Within the healthcare literature, articles on real options have focused on pricing these options. This article is unique to the healthcare literature as it emphasizes the cognitive or strategic aspects of real options. Additionally, this article integrates two techniques for applying the real options approach for interested practitioners using a hospital's imaging department as an example, while providing scholars with additional applications and questions for future research. For practitioners, the implications are that thinking of and planning for capital investments as real options may create greater strategic and operating flexibility than other, more traditional approaches.

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# Real Options Reasoning in Healthcare: An Integrative Approach and Synopsis

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## EXECUTIVE SUMMARY

For the past 40 years, practitioners and researchers alike have been grappling with the natural shortcomings associated with the net present value approach to strategic decision making and capital budgeting. Work by scholars in option pricing theory has evolved into an alternative perspective on strategic capital investments, called "real options." Proponents of real options argue that this is a superior way of approaching decision making and capital budgeting, compared with other approaches, as it allows for greater strategic flexibility and encourages exploration, experimentation, and innovation. Within the healthcare literature, articles on real options have focused on pricing these options.

This article is unique to the healthcare literature as it emphasizes the cognitive or strategic aspects of real options. Additionally, this article integrates two techniques for applying the real options approach for interested practitioners using a hospital's imaging department as an example, while providing scholars with additional applications and questions for future research. For practitioners, the implications are that thinking of and planning for capital investments as real options may create greater strategic and operating flexibility than other, more traditional approaches.

For more information on the concepts in this article, please contact Dr. Williams at [willimsdr@appstate.edu](mailto:willimsdr@appstate.edu).

As the old adage says, "Patience is a virtue." Within the past 30 years or so, strategic and financial management scholars have been formulating a complementary set of theories that incorporates this adage as one of its core characteristics—the option to delay or wait. Intuitively, practitioners have known for some time that delaying a project may clarify uncertainty, thus reducing the potential for a negative occurrence. Take, for example, the situation where a physician group asks a hospital to acquire a new piece of technology and expand its facilities at the same time. The hospital administrator may wish to maintain the right to delay the more expensive project—expanding its facility—until he knows that the requesting physician group has first used the piece of equipment to a satisfactory level. This right or option to delay has value. Thus, patience may not only be a virtue, but it may also have positive economic consequences as well.

Traditional capital budgeting methods, such as the net present value (NPV) approach, do not capture this value to delay, however. Nor do they capture other issues related to operating flexibility and strategic interactions (Dixit 1989). In response to this deficiency in strategic thinking and capital budgeting techniques, a growing body of literature has emerged to help practitioners and researchers deal with corporate decision making.

Scholars working in this field call this body of literature "real options." Real options are investment opportunities that are characterized by

"a limited commitment that creates future decision rights" (McGrath, Ferrier, and Mendelow 2004, 86). Thinking of capital budgeting decisions as real options means thinking of strategic and capital investments as similar to financial stock options. Proponents of real options suggest that this form of strategic thinking and investment is inherently more beneficial than the NPV approach. As Kogut and Kulatilaka (2001, 744) observe, a "real options approach marries the theory of financial options to foundational ideas in strategy, organizational theory, and complex systems."

As illustrated, healthcare practitioners have likely been using this type of logic for decades. Jensen and Warren (2001) note that the pharmaceutical and biomedical industries are the most frequently used examples in the literature. However, our review of the healthcare literature uncovered few articles on real options. Literature on real options can be divided into its financial or pricing aspects and its cognitive or strategic aspects. The healthcare journal articles all deal with the financial or pricing aspects. Thus, after briefly describing the origins of the concept of real options, we focus on the cognitive or strategic aspects and provide examples of strategic applications within the healthcare setting for both practitioners and researchers.

## ORIGINS

Literature on real options emerged from work by financial economists who were developing an option pricing



theory (e.g., Black and Scholes 1972, 1973; Merton 1973). These scholars were seeking to create theories to value financial option contracts. Before this research on options, Miller and Modigliani (MM) (1961) had shown that a firm's market value represented two parts: the present value of its assets and the present value in its growth opportunities in real assets. Myers (1977) proposed thinking of investment opportunities associated with capital budgeting projects (i.e., the growth opportunities in real assets as described in the MM model) as growth options (Trigeorgis 1993). As the literature developed, growth options related to capital budgeting decisions became known as options in real assets or real options. Thus, the literature related to option pricing theory was expanded and applied to capital budgeting issues.

An option is "a security giving the right to buy or sell an asset, subject to certain conditions, within a specified period of time" (Black and Scholes 1972, 637). There are two main types of option contracts: a call option and a put option. A call option allows the holder of the option the right to purchase the underlying asset within a given time and at a specified price (known as the strike or exercise price). A put option allows the holder of the option to sell the underlying asset at the strike price within the given period of the contract. Combinations of put and call options exist as well.

For example, when the hospital mentioned previously purchases the piece of equipment, it also acquires a call option to expand its facilities, and

the option's exercise price is the cost of expansion. In addition, the firm's ability to sell that piece of equipment (even at a loss) can be thought of as a put option. The ability to delay a project is not the only area of flexibility addressed within the literature on real options. The major categories related to real options include the option to initiate, abandon, expand, contract, wait, slow down, speed up, switch, sell, or sequence a project (Bowman and Hurry 1993; Merton 1998; Trigeorgis 1993). From the perspective of real options, an explicit economic value is associated with all of these areas of flexibility.

Several different methods are used to price real options. However, a review of these methods is beyond the scope of this article and is not necessary to understand the logic and applications of real options, which is the focus of this article.<sup>1</sup>

## REAL OPTIONS REASONING

The cognitive aspects of the real options literature are called "real options reasoning" (e.g., McGrath 1996) or real options logic (e.g., McGrath 1997). McGrath, Ferrier, and Mendelow (2004) note that real options reasoning is often described as a "process heuristic [that is, technique] for understanding the economics of sequential resource investment choices." Thus, real options reasoning "accommodates the value of flexibility, differing resource allocation horizons, the process of retrospective sense making, and path dependence" (McGrath and Nerkar 2004, 2).

**FIGURE 1**  
**Investment Approaches**

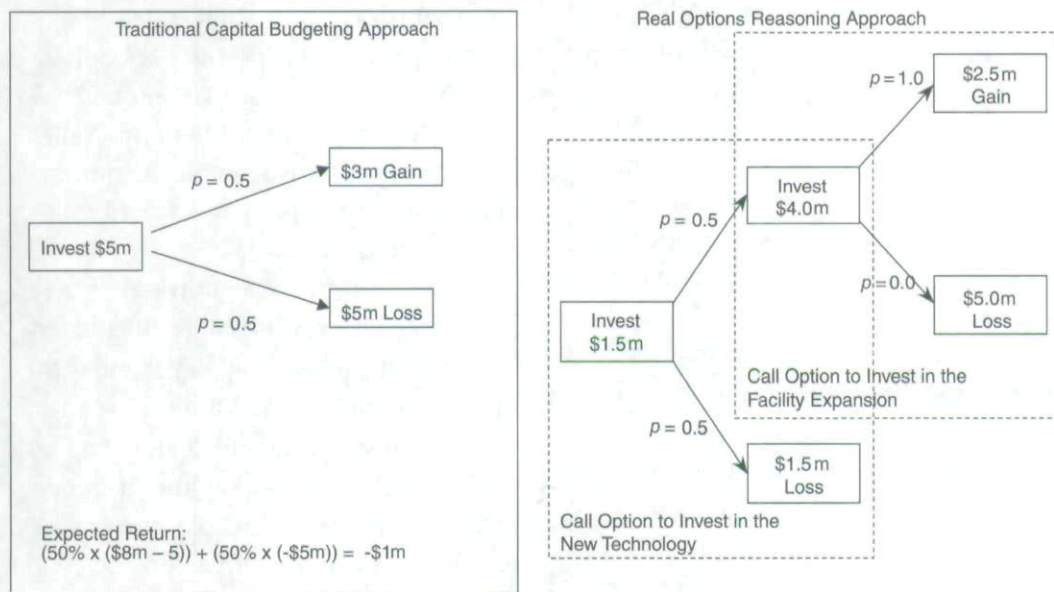


Figure 1 provides a simplified comparison in investment approaches between real options and NPV using our opening example.<sup>2</sup> In the traditional approach, the hospital administrator might contemplate a \$5 million investment in equipment (costing \$1 million) and facilities (costing \$4 million), with a 50 percent probability of generating revenues of \$8 million and a 50 percent probability of losing the investment. The option of delaying may also have an additional cost of \$500,000 for renovations to “house” the new equipment temporarily. In the NPV approach, the expected return is –\$1 million, and the project will most likely be rejected. Now consider the options approach in which a smaller amount, \$1.5 million, is invested (for

equipment and renovations) until more information on its usage is available. If usage and information are positive, the additional \$4 million will be invested, bringing the total investment to \$5.5 million. This real options approach generates an expected positive return of \$500,000. Hence, the two approaches arrive at different conclusions.

It has been noted that the value of flexibility (and thus the real options approach) is greatest when uncertainty is high and managers, through their actions, have the opportunity to affect the outcome or change course (Copeland, Koller, and Murrin 2000; McGrath and Nerkar 2004). To help think about this flexibility systematically, we have expanded and integrated two heuristics or techniques embedded within the



literature related to real options reasoning, which may be useful to strategic management scholars and practitioners—those provided by Miller and Waller (2003) and McGrath and MacMillan (2000). For practitioners, we suggest incorporating both techniques into the strategic management process. To our knowledge, no one has done this. Thus, we propose that real options reasoning be used in a systematic way in addition to individual investment decisions.

### **Practitioner Techniques**

Miller and Waller (2003) suggest joining real options reasoning with scenario planning. The strategic management literature has long used scenario planning as a tool to envision plausible future states. At times, scenario planning has quantitative aspects, but more often, it is a qualitative tool to help decision makers generate options and contingencies. Scenario planning also uses decision trees at times. Both decision trees and scenario planning have been used to clarify uncertainty not only within the real options literature, but also by researchers and practitioners in fields as far apart as strategic and quality management.

We have modified and outlined Miller and Waller's (2003) scenario planning approach to real options. These modifications include (1) applying it to a healthcare setting, (2) reordering steps within their process, (3) adding the plotting of uncertainties via the use of McGrath and MacMillan's (2000) technique, and (4) suggesting that firms also

perform real options pricing during this process. The purpose of scenario planning in this context is to generate, define, and systematize real options and their risks. In this integrated example, the application of McGrath and MacMillan's (2000) technique is embedded within the Miller and Waller (2003) real options scenario-planning approach. This approach is found in Table 1 and Figure 2.

To explain this integrative approach, consider a hospital's imaging department. An imaging department is one of the most capital-intensive settings within a hospital. It is also an area that can help differentiate the hospital or health system as a whole, such as whether a hospital will be considered "high-tech" or "high-touch." Also, many imaging department managers have become more entrepreneurial in their approach to capital investments, and such investments are viewed as strategic assets and part of joint ventures, freestanding subsidiaries, and the like. In this sense, real options reasoning has also been suggested to help entrepreneurs explore their choices (McGrath 1999; Vassolo, Anand, and Folta 2004).

Imaging department managers are constantly exploring new technological innovations and their applications. However, the imaging department manager faces limitations in terms of competition within the hospital for capital expenditures, market or reimbursement uncertainties, and technology uncertainties (i.e., what technology will become the standard treatment protocol and/or

**TABLE 1****Scenario Planning Steps**

- 
1. Scenario planning
    - 1.1. Frame the issue—what are the healthcare issues to be explored?
    - 1.2. Identify participants and solicit input—who are the stakeholders (e.g., physicians, insurance companies)?
      - 1.2.1. Identify potential real options.
    - 1.3. Identify exposures (see Table 2).
      - 1.3.1. General environmental uncertainties
      - 1.3.2. Industry uncertainties
      - 1.3.3. Firm-specific uncertainties
      - 1.3.4. Departmental uncertainties
    - 1.4. Plot market and technological uncertainties (see Figure 3).
    - 1.5. Sketch out possible paths (e.g., decision trees)—what are the best- and worst-case scenarios (possible paths); when/why should we abandon, delay, expand, etc.?
      - 1.5.1. Test plausibility—do the envisioned paths logically follow what we now know?
      - 1.5.2. Perform real options pricing, preferably using decision trees.
    - 1.6. Formulate strategies—based on the previous seven items, define initiatives.
  2. Choose real options investments.
  3. Implementation
    - 3.1. Monitor key contingencies—at the corporate, business, and department levels.
    - 3.2. Design flexibility into the process.
      - 3.2.1. Organizational structures, management processes
      - 3.2.2. Interfirm relationships with stakeholders
    - 3.3. Reassess exposures and options.
    - 3.4. Assess real options categories (e.g., delay, switch) via real options pricing decision tree and possible paths.
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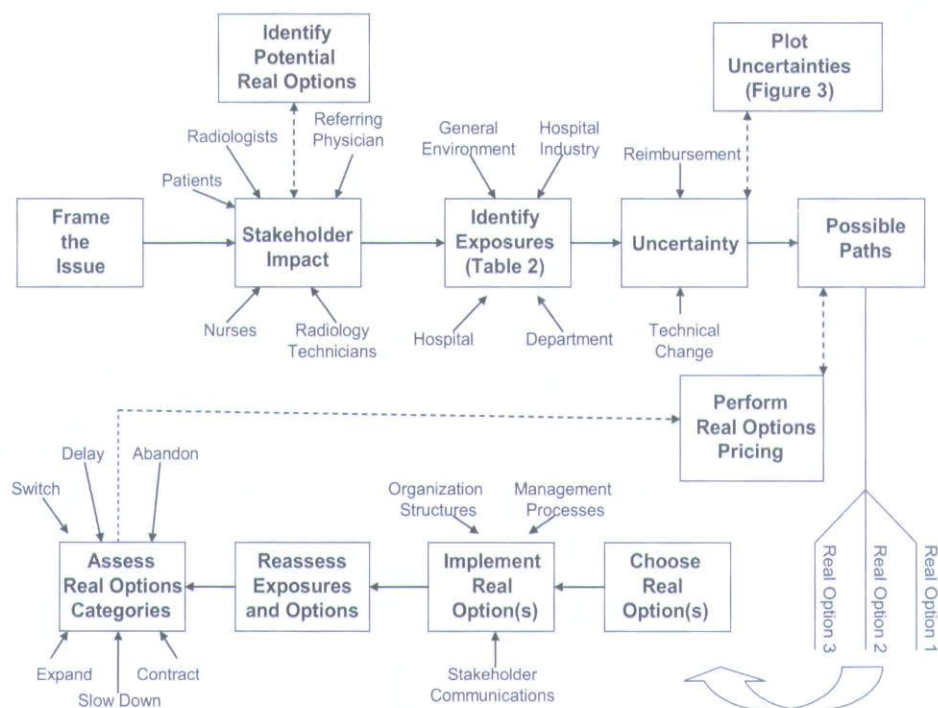
is the technology as advanced “as the salesperson tells us”). With respect to market uncertainties, reimbursement levels have a tendency to change over time. Thus, a technology that is not initially reimbursed may become totally reimburseable as the technology develops and becomes an accepted practice. The reverse is also true.

The first major step after identifying and framing the areas to be explored

is to identify and involve stakeholders. For a hospital’s imaging department, these include, but are not limited to, patients, radiologists, referring physicians, nurses, radiology technicians, payers, and suppliers. Stakeholders will typically define the assumptions related to the remaining steps within the real options scenario planning.

They are also usually the first to suggest which technologies or real options to



**FIGURE 2****Graphical Representation of Scenario Planning Approach**

---Indicates specific activities not found in Miller and Waller (2003)  
 Double arrows indicate results from activity, rejoins the process at that point

pursue. (See "Stakeholder Impact" and "Identify Potential Real Options" in Figure 2.)

Management and stakeholders also need to address internal and external uncertainties. These involve issues in the general and local economies, hospital industry, and the hospital and department specifically. (See "Identify Exposures" in Figure 2.) Table 2 provides examples of these issues. Of particular importance is the need to identify market and technological uncertainties for capital budget projects.

To help assess technological and market uncertainties, McGrath and MacMillan (2000) provide a second technique. Much of the literature on real options has to do with corporate entrepreneurship (O'Brien, Folta, and Johnson 2003). Williams, Duncan, and Ginter (2005) have noted that entrepreneurship is of increasing importance to those in the healthcare field. McGrath and MacMillan's (2000) approach helps corporate entrepreneurs decide which options to pursue based on the option's purpose and associated risks; corporate



**TABLE 2**  
**Exposures and Examples**

Types of Uncertainty	Examples
<b>General Environmental Uncertainties</b>	
Political	Disharmony, lack of cohesive policy
Government policy	Increased regulation, cost-control pressures
Macroeconomic	Cost pressures, loss of employment due to outsourcing, discontinuance of health insurance
Social	Shift in social concern
Natural	Recent natural disasters affecting economic conditions
<b>Hospital Industry Uncertainties</b>	
Input market	Physician shortages, specialty-driven
Product market	Beginnings of consumer-driven, price sensitive because of managed care, quality difficult to measure, differentiation primarily based on services
Competition	Local market dependent, introduction of substitutes (i.e., outpatient facilities)
<b>Hospital Uncertainties</b>	
Operations	Supply of labor (e.g., nurses), complexity
Liabilities	Malpractice
Research and development	Limited
Credit	Slow accounts receivable because of payers
Behavioral	Difficulties associated with managing professionals (e.g., nurses, physicians)
<b>Department (Imaging) Uncertainties</b>	
Operations	Supply of labor (e.g., technicians)
Technology	Cost, short life cycle, compatibility, standard
Market	Reimbursement

entrepreneurs usually pursue multiple options simultaneously. The pursuit of multiple options is known as creating a portfolio of options (Bowman and Hurry 1993).

McGrath and MacMillan (2000) distinguish among three types of options: positioning, scouting, and stepping-stones. The distinctions among these options are based on the nature of the uncertainty the corporate entrepreneur faces—whether these are market uncertainties or technological uncertainties. Positioning options have

high technological uncertainty but low market uncertainty. Scouting options have low technological uncertainty but high market uncertainty. Stepping-stone options have high market and technological uncertainties.

Additionally, McGrath and MacMillan (2000) note that firms may also wish to make nonincremental investments. These are called enhancement launches and platform launches. Enhancement and platform launches do not require a limited commitment that creates future decision rights.

Enhancement launches are new attributes for existing products, services, or service lines. Platform launches are new areas that allow one to offer new products or services. The difference between real options and launches is that in launches one typically commits to an up-front investment. In real options (e.g., scouting), one makes an incremental investment (i.e., acquires an option) with the intent of exploring and exercising the option (i.e., making further investments) at a later date. In terms of deciding how to use this technique, McGrath and MacMillan (2000, 180) observe that "the core concept is to let your strategy and available resources guide your choice of how much emphasis to place on each of the categories."

An example of an enhancement launch is upgrading from a closed magnetic resonance imaging (MRI) machine that operates at 1.0 tesla (magnet strength) to an open MRI that operates at 1.5 tesla, provides better picture quality and faster imaging, and is generally perceived by the patient as being less confining. An example of a platform launch is "executive" or "boutique" medicine. In this case, the department acquires new, existing technology to create a new service or repackage services already offered, and the value proposition is focused on customer service (e.g., such as access and/or convenience). It bundles technology already offered (e.g., ultrasound, computed tomography [CT] scan) into a new marketing effort for the "worried well" (i.e., those who can afford it and wish to get a package of diagnostic screenings).

This executive medicine effort may allow the hospital to launch into other corporate medicine programs such as occupational health. Enhancement and platform launches both involve capital expenditures that generally are low with respect to market and technological uncertainties (i.e., the technology is known and accepted, and there is generally a market for it).

Real options, on the other hand, are associated with an element of exploration—uncertainty is an inherent quality (Bowman and Moskowitz 2001). In this respect, its proponents argue, over time real options reasoning should improve institutional and individual learning (McGrath, Ferrier, and Mendelow 2004). An example of a scouting option is virtual colonoscopy. Here, the technology is known to work; however, few payers currently reimburse for this service, and it is not known if or when the payers will reimburse. We have a slightly different case with our positioning option. Our example is cardiac imaging. Here, we have three competing technologies: positron emission tomography (PET), CT, and MRI. All three technologies are known to work relatively well; however, it is not known which technology will become the standard (and thus *the* reimbursed technology). For cardiology patients (typically the most profitable patients for a hospital), currently none of these technologies are being reimbursed by most payers. Finally, our example for stepping-stone options is micro or nano body-imaging technology. This technology is in the developmental stage, and no payers currently reimburse for its use. This



technology, however, has tremendous potential for those with vascular, cardiothoracic, digestive, and respiratory illnesses.

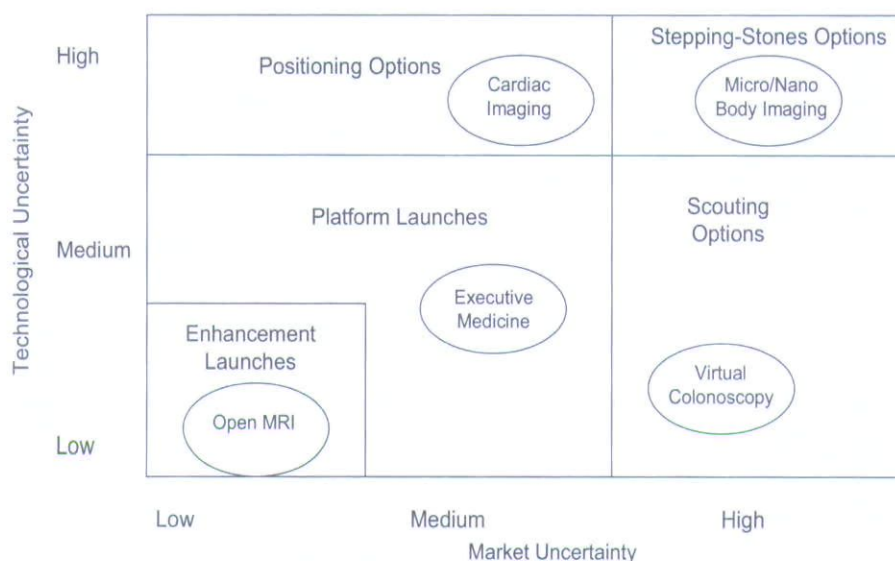
Within a portfolio of real options, the imaging department manager must decide where and how much to invest; very few managers are able to acquire all technologies. The NPV approach would most likely suggest only the two launches. This may be a good short-term strategy, but the acquired technology may be soon outdated and, thus, competitive advantage will be lost.

The use of real options reasoning allows the manager to use various strategies to discern which technology to pursue in the long term, with incremental investments and alternative financing arrangements facilitating the real options approach. For example, the manager may wish to use nooption thinking and acquire outright the enhancement and platform launches (e.g., open MRI, executive medicine). For the hospital's cardiac imaging program, it may wish to form a joint venture with a company that provides mobile PET, CT, and/or MRI units. Once the standard (and thus reimbursement) has been established, the program managers can acquire the appropriate technology, if they desire. For scouting options, the hospital may wish to lease with an option to buy the technology associated with virtual colonoscopy should the market uncertainty become favorably clarified. In this example, leasing the equipment is similar to a call option written on a purchase option. For a stepping-stone option, the department can send its employees to educational seminars (i.e., make a

minor investment); cosponsor research and get more accurate information on its technological progress; or become an "alpha-site" cosponsor, whereby research is performed on the hospital campus but the hospital does not bear the full cost of the new micro or nano body-imaging technology. At any time (and within the constraints of the arrangements), the hospital can switch, abandon, delay (or the like) any of the options with less investment than it otherwise may have incurred. Figure 3 plots these market and technological uncertainties.

Once one has identified and assessed the market and technological uncertainties associated with a portfolio of real options, one can discuss the possible paths of each option. At this juncture, managers discuss up front with the stakeholders or select stakeholders the assessment categories of delaying, switching, abandoning (and the like) for each investment decision. This means consensus is sought for a path for a given real option. In other words, for a given real option if "x" happens (such as a change in technology or reimbursement), then our possible path is to "y" (e.g., delay, switch, expand). This up-front discussion may reduce uncertainty and friction later, thus improving strategic flexibility, which has value from a real options perspective. At this point real options pricing can be performed.

Based on the previous analysis, an organization may wish to limit the number or type of real options to implement. (See "Choose Real Options" in Figure 2.) Implementing real options may involve new or

**FIGURE 3****Hospital Imaging Department's Portfolio of Options**

Source: Adapted from McGrath and MacMillan (2000).

restructured organizational and management processes—all of which are communicated with and/or derived from the stakeholders. This action is labeled as “Implement Real Options” (Figure 2).

In addition to changing environmental conditions, management’s action with respect to real options may cause competitors and stakeholders to respond. Thus, it may be necessary to “Reassess Exposures and Options,” which is performed in tandem with “Assess Real Options Categories” (Figure 2). These assessment categories mean the organization looks at the real options and their possible paths and decides whether to delay, abandon, switch, speed up, and the like. During

this assessment, the organization may also decide to re-perform real options pricing for a given project or projects.

Finally, the manager and a select group of stakeholders may wish to evaluate and modify this entire process in the future. Miller and Waller (2003) and others note that no process or model fits all organizations and industries exactly. We would add that many of the steps outlined here are iterative in nature, and there is much going back and forth between the steps.

Admittedly, it should be noted that real options reasoning and our proposed process are not without their own sets of issues and problems. These include escalating commitment (e.g., Zardkoohi 2004), hysteresis (e.g., Dixit



1989), and other psychological biases (Adner and Levinthal 2004). Escalating commitment can occur when an organization overcommits to a course of action. Using the previous example, in acquiring the piece of technology the hospital administrator may have "escalated" his commitment beyond the objective facts of the situation and may perceive an inability to not expand the facility. Hysteresis is the inability to reverse course when conditions change unfavorably. For example, if equipment usage was below expectations because of a change in reimbursement, the prudent thing may be for the hospital to use its put option (i.e., sell the piece of equipment, even at a loss). This may not be possible because of other factors, such as physician preference.

## SYNOPSIS AND RESEARCH APPLICATIONS

Given the nascent nature of the literature on real options reasoning (McGrath, Ferrier, and Mendelow 2004) and the uniqueness of the healthcare sector, researchers may find it beneficial to further explore this developing theory. Following is a synopsis of the literature on real options and areas of potential inquiry for researchers.

Table 3 presents a list of various studies within the real options reasoning literature. These articles were identified by a four-step approach. First, we conducted a search using the term "real options" within the abstract section of articles and within the CINAHL, EBSCOHOST, and JSTOR databases. Next, we did specific searches within the healthcare journals that were included in the journal rankings' study

conducted by Williams and colleagues (2002). Of note, we found no healthcare journal articles that dealt primarily with real options reasoning. Third, we performed specific searches of journals included in the most influential management journals, as reported by Tahai and Meyer (1999), and the top-tier entrepreneurship journals, as reported by Boals (2006). Finally, because much of the literature on real options pricing has an inherent real options reasoning aspect, we reviewed much of the accounting, finance, and economic literature related to real options. However, we found only one article specifically focusing on real options reasoning.

From this review, four broad themes stand out. First, it is apparent that the boundaries in this literature **have not been clearly delineated**, as a series of articles published in the January 2004 issue of *The Academy of Management Review* suggests. Second, we do not know much about real options reasoning usage, especially by healthcare practitioners. In other words, we do not know which organizations are using real options reasoning, or how and why they are using it. Third, and similar to Folta and O'Brien (2004), we found that most of the literature was metaphorical; our review found only two empirical articles related to real options reasoning and the healthcare sector. Vassolo, Anand, and Folta (2004) examined pharmaceutical and biotechnology companies, and McGrath and Nerkar (2004) examined pharmaceutical companies. Finally, the literature on real options reasoning has not tested whether the use of real options reasoning has increased firm

TABLE 3

## Real Options Reasoning: Literature Review

Author(s)*	Real Options		Results/Uniqueness
	Pricing/Reasoning/ General†/Heuristic	Real Options Stream	
Kogut (1991)	Reasoning (empirical)	Expansion	Supports concept of joint ventures as real options to expand given technological and market uncertainties
Hurry, Miller, and Bowman (1992)	Reasoning	Shadow option	Shows differences between Japanese and U.S. venture capitalist use of real options
Bowman and Hurry (1993)	Reasoning	Resources	Introduces shadow options and option chains
Kogut and Kulatilaka (1994)	General/heuristic	Platform investments	Bridges stream between current use of assets and future organizational capabilities
McGrath (1996)	Reasoning	Option chains	Shows entrepreneurs using social capital to create option chains
McGrath (1997)	Reasoning	Technology positioning options	Links technology options with other (broader) environmental issues
McGrath (1999)	Reasoning	Failure	Uses real options reasoning to describe failure by entrepreneurial firms
Bowman and Moskowitz (2001)	Pricing and reasoning	Flexibility	Illustrates practical difficulty in using analysis
Kogut and Kulatilaka (2001)	Reasoning	Capabilities	Shows that real options as an appropriate theoretical foundation for heuristic frames relate to exploration and value capabilities
DeSchryver and Asselbergh (2003)‡	Reasoning	Innovation	Links pharmaceutical companies' activities with real options reasoning to reduce uncertainty
Miller and Waller (2003)	Reasoning/ heuristic	Risk exposures	Links real options to scenario planning
O'Brien, Folta, and Johnson (2003)	Reasoning (empirical)	Deferment	Empirically tests usage of real options reasoning by entrepreneurs and finds that high uncertainty dissuades entry into new venture
Adner and Levinthal (2004)	Reasoning	Abandonment	Illustrates that the less structured a firm's abandonment criteria, the less like they are to be real options
Folta and O'Brien (2004)	Reasoning (empirical)	Deferment or growth	Demonstrates that the relationship between uncertainty and entry is not monotonic
McGrath, Ferrier, and Mendelow (2004)	Reasoning	Abandonment	A response to Adner and Levinthal (2004)
Miller and Arkan (2004)	Pricing and reasoning	Technology options	Compares real options pricing to evolutionary and real options reasoning
McGrath and Nerkar (2004)‡	Reasoning (empirical)	Pursuit of an option	Finds that decision makers either explicitly or implicitly use real options reasoning
Vassolo, Anand, and Folta (2004)‡	Reasoning (empirical)	Equity alliances	Illustrates interactions by exploratory investments both within and between portfolios
Zardkoohi (2004)	Reasoning	Escalating commitment and abandonment	Shows that firm rules, criteria, procedures, and other theories usually limit escalation of commitment issues
Warner, Fairbank, and Steensma (2006)	Reasoning	Acquisition	Shows early acquisition as a growth option

\* Studies are ordered by date.

† The research applies equally to both real options reasoning and pricing.

‡ Healthcare related (pharmaceutical and/or biotechnology).



performance or led to competitive advantage. Research in these areas would add to the literature on both healthcare and real options reasoning and, perhaps, provide greater guidance to healthcare organizations in their use.

To assist with this work, we offer Table 4, which provides healthcare examples of potential real options. The examples in Table 4 can be used to address any of the issues identified in the broad themes or the following research questions. Table 4 uses Burns's (2002, 2005) expanded view of the U.S. healthcare value chain. The value chain components include purchasers, fiscal intermediaries, providers, product intermediaries, and producers. We use one area (e.g., insurers, hospitals) within these components (e.g., purchasers, fiscal intermediaries) and the major categories (e.g., delay, switch) described in the literature on real options to highlight how practitioners may use real options reasoning, and where researchers may find it profitable to spend their future efforts.

From Table 4, several questions come to mind:

- How do healthcare-specific regulations and laws (e.g., Stark, inurement, certificate of need) moderate or mediate real options approaches?
- Do healthcare organizations systematize real options approaches (i.e., do they incorporate it into their strategic planning process)?
- Do some areas along the value chain use real options approaches more or less than other areas on the value chain? Why?

- How does one party's (e.g., employer) real options approach affect another party's (e.g., insurer) real options approaches?
- Are healthcare providers (e.g., hospitals) less likely to "abandon" an initiative than other nonhealthcare industries because of their nature (i.e., service) and visibility? (That is, can a hospital abandon an expansion of its facilities in the middle of construction to the same extent as a manufacturing plant?)
- Has the real options approach led to greater profitability for the adopting healthcare firm?
- Have real options approaches led to more or less diversification in healthcare?
- How can real options approaches be adopted to encourage greater healthcare corporate entrepreneurship?
- Does an industry life cycle affect real options approaches?

## CONCLUSION

This article highlights the literature on real options reasoning. We provide applications for practitioners and healthcare researchers alike, noting that the literature remains pre-paradigmatic and in need of further research. We believe this is the first article to suggest that practitioners may wish to consider using the two real options reasoning techniques as part of their strategic management process.

We realize practitioners may have been using real options reasoning for some time. Yet we also believe they may have been troubled when they sought to express and reconcile

**TABLE 4**  
**Healthcare Examples of Potential Real Options**

Option Category	Purchaser (Employers)	Fiscal Intermediaries (Insurers)	Providers (Hospitals)	Product Intermediaries (GPO) <sup>†</sup>	Producers (Medical Device)
Initiate	Offer insurance*	New product offering (MSA) <sup>#</sup>	New service (obstetrics)	New service (PBM) <sup>‡</sup>	New products (prosthetics)
Abandon	Discontinue insurance	New product offering (MSA)	New service (obstetrics)	New service (PBM)	New products (prosthetics)
Expand	Insurance benefits	New geographic areas	Beds	New geographic areas	Production capacity
Contract	Insurance benefits	Unprofitable geographic areas	Beds (semiprivate to private)	Unprofitable geographic areas	Production capacity
Wait/delay	Insurance plan offerings (indemnity, PPO, HMO <sup>§</sup> )	New product offering (MSA)	Beds (semiprivate to private)	Entering new markets	Production capacity
Slow down	Insurance plan offerings (indemnity, PPO, HMO)	Provider network development	Beds (semiprivate to private)	Adding hospitals	Production capacity
Speed up	Insurance plan offerings (indemnity, PPO, HMO)	Provider network development	Beds (semiprivate to private)	New services	Production capacity
Switch	Insurance plan offerings (indemnity, PPO, HMO)	Third-party administrators	Change bassinets to NICU** beds	Producers	Means of production
Sell	n/a	HMO license	Sell certificate of need	Product lines (PBM)	Production facilities (outsource)
Sequence	Insurance plan offerings (indemnity [year 1], PPO [year 2], HMO [year 3])	Insurance plan offerings (indemnity [year 1], PPO [year 2], HMO [year 3])	Open obstetrics unit, then NICU	Entering new markets	Production increase with marketing efforts

\* Not traditionally thought of as a capital expense, but Dixit and Pindyck (1994) note that real options can be applied to other situations involving uncertainty, risk, and sunk costs.

<sup>†</sup> GPO = group purchasing organization; <sup>‡</sup> PBM = pharmacy benefits management company; <sup>§</sup> PPO = preferred provider organization, HMO = health maintenance organization; <sup>#</sup> MSA = medical savings account; \*\* NICU = neonatal intensive care unit.



their logic related to capital budgeting and the NPV approach. We offer this article as a starting point toward a better understanding of these issues.

## Notes

1. For those interested in various real options pricing methodologies, see Copeland, Koller, and Murrin 2000; Copeland and Tufano 2004; Dixit and Pindyck 1994, 1995; Luehrman 1998; Magiera and McLean 1996; Maurer 2001; and Smyth and Swinand 2002.
2. Note that this is not an example of real options pricing, but it is merely an illustration of real options logic, the format of which is partially borrowed from McGrath (1996). The value of the option to delay is the difference between the NPVs for the two approaches: Option value to delay =  $0.5M - (-1.0M) = 1.5M$ .

## References

- Adner, R., and D. A. Levinthal. 2004. "What is Not a Real Option: Considering Boundaries for the Application of Real Options to Business Strategy." *Academy of Management Review* 29 (1): 74–85.
- Black, F., and M. Scholes. 1972. "The Valuation of Option Contracts and a Test of Market Efficiency." *Journal of Finance* 27 (2): 399–417.
- . 1973. "The Pricing of Options and Corporate Liabilities." *Journal of Finance* 81 (3): 637–54.
- Boals, K. 2006. "Journal Rankings." St. Louis University, John Cook School of Business, Entrepreneurship Program, Entrepreneurship Education Resources. [Online article; retrieved 3/8/07.] <http://eweb.slu.edu/journal.rankings.htm>.
- Bowman, E. H., and D. Hurry. 1993. "Strategy Through the Option Lens: An Integrated View of Resource Investments and the Incremental-Choice Process." *Academy of Management Review* 18 (4): 760–82.
- Bowman, E. H., and G. T. Moskowitz. 2001. "Real Options Analysis and Strategic Decision Making." *Organization Science* 12 (6): 772–77.
- Burns, L. R. 2002. *The Health Care Value Chain*. San Francisco: Jossey-Bass.
- . 2005. *The Business of Healthcare Innovation*. New York: Cambridge University Press.
- Copeland, T., T. Koller, and J. Murrin. 2000. *Valuation: Measuring and Managing the Value of Companies*, 3rd edition. New York: John Wiley & Sons.
- Copeland, T., and P. Tufano. 2004. "A Real-World Way to Manage Real Options." *Harvard Business Review* (March): 90–99.
- DeSchryver, T., and G. Asselbergh. 2003. "The Dynamics of Real Options Thinking on Competition through Innovation: The Case of the Pharmaceutical Industry." *California Management Review* 13 (2): 16–27.
- Dixit, A. 1989. "Entry and Exit Decisions Under Uncertainty." *Journal of Political Economy* 97 (3): 620–38.
- Dixit, A. K., and R. S. Pindyck. 1994. *Investment Under Uncertainty*. Princeton, NJ: Princeton University Press.
- . 1995. "The Options Approach to Capital Investment." *Harvard Business Review* (May-June): 105–18.
- Folta, T. B., and J. P. O'Brien. 2004. "Entry in the Presence of Dueling Options." *Strategic Management Journal* 25: 121–38.
- Hurry, D., A. T. Miller, and E. H. Bowman. 1992. "Calls on High-Technology: Japanese Exploration of Venture Capital Investments in the United States." *Strategic Management Journal* 13: 85–101.
- Jensen, K., and P. Warren. 2001. "The Use of Options Theory to Value Research in the Service Sector." *R&D Management* 31 (2): 173–80.
- Kogut, B. 1991. "Joint Ventures and the Option to Expand and Acquire." *Management Science* 37 (1): 19–33.
- Kogut, B., and N. Kulatilaka. 1994. "Options Thinking and Platform Investments: Investing in Opportunity." *California Management Review* 36 (2): 82–71.
- . 2001. "Capabilities as Real Options." *Organization Science* 12 (6): 774–58.
- Luehrman, T. A. 1998. "Investment Opportunities as Real Options: Getting Started

- on the Numbers." *Harvard Business Review* (July-August): 51-67.
- Magiera, F. T., and R. A. McLean. 1996. "Strategic Options in Capital Budgeting and Program Selection under Fee-For-Service and Managed Care." *Health Care Management Review* 21 (4): 7-17.
- Maurer, R. T. 2001. "Financial Valuation of Incentive Arrangements in Managed Care Contracts: A Real Options Approach." *Journal of Health Care Finance* 28 (1): 39-61.
- McGrath, R. 1996. "Options and the Entrepreneur: Toward a Strategic Theory of Entrepreneurial Wealth Creation." *Academy of Management Proceedings* (1996): 101-5.
- . 1997. "A Real Options Logic for Initiating Technology Positioning Investments." *Academy of Management Review* 22 (4): 974-96.
- . 1999. "Falling Forward: Real Options Reasonings and Entrepreneurial Failure." *Academy of Management Review* 24 (1): 13-30.
- McGrath, R., W. J. Ferrier, and A. L. Mendelow. 2004. "Real Options as Engines of Choice and Heterogeneity." *Academy of Management Review* 29 (1): 86-101.
- McGrath, R., and I. C. MacMillan. 2000. *The Entrepreneurial Mindset*. Boston: Harvard Business School Press.
- McGrath, R., and A. Nerkar. 2004. "Real Options Reasoning and a New Look at the R&D Investment Strategies of Pharmaceutical Firms." *Strategic Management Journal* 25: 1-21.
- Merton, R. C. 1973. "Theory of Rational Option Pricing." *Bell Journal of Economics and Management Science* 4 (1): 141-83.
- . 1998. "Applications of Option-Pricing Theory: Twenty-Five Years Later." *American Economic Review* 88 (3): 323-49.
- Miller, K. D., and A. T. Arikan. 2004. "Technology Search Investments: Evolution, Option Reasoning, and Option Pricing Approaches." *Strategic Management Journal* 25: 473-85.
- Miller, K. D., and H. G. Waller. 2003. "Scenarios, Real Options, and Integrated Risk Management." *Long Range Planning* 36: 93-107.
- Miller, M. H., and F. Modigliani. 1961. "Dividend Policy, Growth, and the Valuation of Shares." *Journal of Business* 34 (4): 411-33.
- Myers, S. C. 1977. "Determinants of Corporate Borrowing." *Journal of Financial Economics* 5: 147-76.
- O'Brien, J. P., T. B. Folta, and D. R. Johnson. 2003. "A Real Options Perspective on Entrepreneurial Entry in the Face of Uncertainty." *Managerial and Decision Economics* 24 (8): 515-33.
- Smyth, J. P., and P. Swinand. 2002. "Evaluating Capital Investment Opportunities: Capturing the Value of Flexibility." *Healthcare Financial Management* 56 (11): 60-65.
- Tahai, A., and M. J. Meyer. 1999. "A Revealed Preference Study of Management Journals' Direct Influences." *Strategic Management Journal* 20 (3): 279-96.
- Trigeorgis, L. 1993. "Real Options and Interactions with Financial Flexibility." *Financial Management* (Autumn): 202-24.
- Vassolo, R. S., J. Anand, and T. B. Folta. 2004. "Non-Additivity in Portfolios of Exploration Activities: A Real Options-Based Analysis of Equity Alliances in Biotechnology." *Strategic Management Journal* 25: 1045-61.
- Warner, A. G., J. F. Fairbank, and H. K. Steensma. 2006. "Managing Uncertainty in a Formal Standards-Based Industry: A Real Options Perspective on Acquisition Timing." *Journal of Management* 32 (2): 279-87.
- Williams, D. R., W. J. Duncan, and P. M. Ginter. 2005. "Healthcare Administration Education in the 21st Century: The Case for Entrepreneurship." *Health Administration Education* 22 (3): 283-98.
- Williams, E. S., R. T. Stewart, S. O'Connor, G. T. Savage, and R. Shewchuk. 2002. "Rating Outlets for Health Care Management Research: An Update and Extension." *Medical Care Research and Review* 59 (3): 337-52.
- Zardkoobi, A. 2004. "Do Real Options Lead to Escalation of Commitment?" *Academy of Management Review* 29 (1): 111-19.